DOCUMENT RESUME

ED 162 753 PS 010 275

AUTHOR Firestone, Philip; Martin, Jaclynn E.
TITLE An Analysis of the Hyperactive Syndrome: A Comparison of Hyperactive, Behavior Problem, Asthmatic and Normal Children.
SPONS AGENCY Ontario Mental Health Foundation, Toronto; Ontario Ministry of Health, Toronto.
PUB DATE [78]
GRANT OMH-DM-304; OMHF-652-76A
NOTE 30p.

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS *Asthma; *Attention; *Behavior Problems; Children; *Clinical Diagnosis; *Hyperactivity; Measurement; Motor Reactions; Reaction Time; Research; Self Control

ABSTRACT

This study attempted to identify cognitive and behavioral deficits which might be unique to hyperactive children. Fifty children between the ages of 5 and 12 were subjects of the investigation. Four experimental groups were formed: Hyperactive (HA), Behavior Problem Children (BP), Severely Asthmatic Children (AC), and Normal Control Children (NC). Several commonly used paper and pencil tests measuring variables related to impulsiveness, attention and motor inhibition were administered individually. Reaction time measures were taken while the subject was seated on a stabilimetric cushion which automatically recorded gross motor activity. Results suggest that hyperactive children are more inattentive, more impulsive, and more easily frustrated than normal children. They also appeared more active than the controls. The BP group was similar to the HA group on all but 3 measures. BP children shared deficits in impulse control but not the HA group's attentional problems. The AC group performed as poorly as the HA group on several measures. Asthmatic children shared deficits in impulse control and motor inhibition with HA children, but did not share their problems with attentional processes. The only deficit unique to the HA group was that of attention. (Author/RH)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED162753

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

An Analysis of the Hyperactive Syndrome: A Comparison of Hyperactive, Behavior Problem, Asthmatic and Normal Children

Philip Firestone, Ph.D.
Children's Hospital of Eastern Ontario

and

Carleton University, Ottawa

Jaclynn E. Martin, M.A.
Carleton University, Ottawa

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Philip Firestone
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

PS 010275

This research was supported, in part, by grants from the Ontario Ministry of Health (DM-304) and The Ontario Mental Health Foundation (#652-76A).
Reprints may be requested from Dr. Firestone, CHEO, 401 Smyth Road, Ottawa, Ontario K1H 8L1.

ABSTRACT

In an attempt to determine whether the commonly described deficits associated with hyperactivity- inappropriate activity, short attention span, low frustration tolerance, impulsivity - are unique to this population, hyperactive, behavior problem, asthmatic and normal children were studied. Tests often used in the research with hyperactives were administered. Hyperactives, when compared to normals, did show deficits in the aforementioned areas. However, when compared to the behavior problem and asthmatic children only the attentional deficits clearly differentiated the hyperactives from the other children.

An Analysis of the Hyperactive Syndrome:

Hyperactivity is one of the most common childhood problems encountered by both clinicians and educators today. Recent estimates apply this label to between 7% and 10% of the school age population, although previous estimates have ranged from 3% to 20% (Stewart, Pitts, Craig and Dieruf, 1966). Originally thought to be due largely to organic factors or birth complications, controlled investigations have not found any significant differences in these areas between groups of hyperactives and normal controls (Dubey, 1976; Douglas, Werry and Weiss, 1965; Sroufe, 1975). However, there has been evidence that congential factors may influence the development of hyperactivity with the discovery of a higher incidence of minor physical anomalies in these children when compared to normal children (Firestone, Lewy and Douglas, 1976, Rapoport and Quinn, 1975, Waldrop and Halverson, 1971). However, more extensive investigations comparing hyperactives to other pathological groups have not reported similar differences. When autistic and retarded children of idiopathic origin and hyperactives were studied, it was discovered that there were more minor physical anomalies in all these groups than with normal controls, (Firestone, Peters, Rivier and Knights, 1977; Steg and Rapoport, 1975). In fact, Firestone et al (1977) have found that hyperactives, retardates, their siblings and parents had equal numbers of minor anomalies that were significantly higher than those in normal control children and their families. There was no evidence of behavior disorders in the siblings of the probands.

These results suggest that minor physical anomalies may be found more frequently in many behaviorally disordered children and are not unique to hyperactives.

Several deficits in the cognitive and behavioral spheres of hyperactive children have been identified. Although early investigations suggested that hyperactives were much more active than normal controls, more systematic research has revealed that it is not the overall activity level that distinguishes these children but its social inappropriateness (Barkley and Ullman, 1975; Keough, 1971; Werry and Sprague, 1970). In addition, it is generally reported that the major cognitive deficits of hyperactives lie in the areas of an inability to sustain attention, (Douglas, 1972a; Douglas 1974; Cohen and Douglas, 1972; Sykes, Douglas and Morganstern, 1972; Firestone and Douglas, 1975) poor impulse control (Campbell, Douglas and Morganstern, 1971; Douglas, 1972a, 1974; Firestone and Douglas, 1975; Meichenbaum and Goodman, 1971; Palkes, Stewart and Kahana, 1968) and low frustration tolerance (Campbell & Douglas, 1972; Marwit & Stenner, 1971; Parry & Douglas, 1974; Schrager et al, 1966, Douglas, 1977). However, a major problem with research in this area is that virtually all studies to date have compared hyperactives to normal controls. The history of research with hyperactive children as well as other pathological groups (Quay and Werry, 1972, Steg and Rapoport, 1975, Firestone et al., 1977) has suggested that comparison of

pathological groups with normal controls is insufficient to adequately describe the uniqueness of a disorder. Specifically, it is possible that the reported deficit of hyperactive children may not be sufficient to delineate the disorder but rather may be common to a number, if not all, pathological groups of children.

The present study was an attempt to describe those deficits that might be unique to hyperactive children. In order to achieve this goal, hyperactive, asthmatic, behavior problem and normal control children were studied. Asthmatic children were chosen as one reference group because they are a large group of easily identifiable children who do not demonstrate significant emotional pathology or abnormal parenting (Quay & Werry, 1972). However, these youngsters do experience a considerable amount of attention from health care professionals. The four groups of children were given some of the most commonly reported tests in the research literature on hyperactivity.

METHOD

Subjects

Fifty children between the ages of 5 and 12 from the Children's Hospital of Eastern Ontario took part in the investigation. The children were required to have a Peabody Picture Vocabulary I.Q. of 80 or higher and to be living at home with at least one parent.

Excluded from the samples were children showing definite signs of brain damage, epilepsy or psychosis and those on any form of psychotropic medication. Table 1 describes the population under investigation.

Hyperactive Children (HA)

Twelve subjects were diagnosed as hyperactive by a pediatrician and a psychologist and had four primary problems; overactivity, short attention span, impulsivity and an inability to tolerate frustration. In addition, problems with aggressiveness, tantrums or oppositional behavior had to be present. These characteristics had to be present since early childhood ($1\frac{1}{2}$-2 years of age) and be evident at home and school. In addition, each child had an average score of 1.5 or higher on The Hyperactivity Factor of Conners (1969) rating scale for teachers (TRS).

Behavior Problem Children (BP)

Any of the children thought to be hyperactive by some observors but not unanimously rated as hyperactive by the four observors (parents, teachers, pediatrician, psychologist) were placed in this group. Thus these children were showing problematic behaviors of the "conduct-disorder" type, but either home or school behavior was not seen as a severe problem, or their developmental histories were not consistent with hyperactivity.

Asthmatic Children (AC)

These subjects were selected from the total population of

asthmatic children hospitalized during 1975 or 1976. Each child had been hospitalized for at least three nights for breathing difficulties during this period. This was an attempt to ensure that only the more serious cases be accepted into the investigation.

Normal Control Children (NC)

Included in this category were children attending the out-patient medical clinics during 1975-1976. These children were seen at the hospital for annual medical examinations or minor medical problems (abrasions, influenza, etc.), children with chronic illnesses and those who had spent more than two nights in a hospital during the designated period were excluded from the study.

RATING SCALES, TESTS AND APPARATUS

Conners' Rating Scale

Conners (1969) has developed a widely used rating scale for teachers. This scale of 39 items has been factor analyzed to give 5 factors: (1) conduct-problem, (2) inattentive-passive, (3) tension-anxiety, (4) hyperactivity, and (5) sociability. The score for each factor is based upon the mean of the items within the factor (a 4-point scale, 0-3, is used). A score of 1.5 or higher on the hyperactivity factor is a frequently used criterion for inclusion into a hyperactive group.

Matching Familiar Figures Test

The children's form of the MFF, a test of impulsivity, consists of 12 standard pictures familiar to children and six variants of

each standard. The S must point to that variant which is identical to the standard which remains in view. Two scores are obtained for each S:

1) the mean latency to the first response on each of the 12 items; and

2) the total number of errors on each item.

Story Completion Test

Douglas and her colleagues have developed a semi-structured, projective technique for use with children (Douglas, 1965, Campbell & Douglas, 1972; Parry and Douglas, 1974). In this test (Parry & Douglas, 1974) eight unfinished stories are presented to each child. Each story depicts a hero who is about to embark on an interesting experience and some external event occurs which threatens to interfere. The story, which is read aloud by the experimenter, is stopped at this point. The examiner then reads three alternative endings and the S is asked to choose which ending best completes the story. These endings are coded as either, 1) denial; 2) pessimism; or 3) compromise. Douglas and her colleagues have found that hyperactives tend to either deny the existence of frustrating events or respond with extreme pessimism. Non-hyperactive children between 6 and 12 years of age usually react realistically and compromise.

Maze Test

This maze test is based on the Porteus Mazes Test (Porteus, 1968). The examination of qualitative scores (Q-scores) instead of mental ages or test quotients on the Porteus Mazes gives an

indication of impulse control rather than I.Q. or planning ability (Erikson & Roberts, 1967). In the present study an automated version of the maze was used which simplifies collection of Q-scores by automatically recording the number as well as the duration of contacts with the sides of the maze. The task requires a child to run a stylus through a maze which is upright. The maze is completed twice with the dominant hand. The average score for the trials is computed. Total time to complete the task is also monitored. Norms for this task have been collected by Knights and Moule (1968).

Reaction Time Apparatus

The reaction time apparatus has been used previously (Cohen and Douglas, 1972) and has been shown to discriminate between normal and hyperactive Ss in addition to being sensitive to the effects of methylphenidate (Cohen, Douglas and Morganstern, 1971; Firestone, Davey, Goodman and Peters, 1977; see Firestone and Douglas, 1975, for a full description).

Two measures were taken on this task: a) mean reaction time, and b) inappropriate responses to warning signals or responses while the subject was not to respond with the apparatus. These responses are designated false starts, interstimulus responses and redundant response.

Stabilimetric Cushion

During the reaction time test children were seated in an

armchair fitted with a stabilimetric cushion designed to measure gross motor activity. Sensitive switches, located under the foam at the four corners of the cushion, automatically record any movement on a display panel out of sight of the child. This type of apparatus was previously used by Sprague and Toppe (1966).

PROCEDURE

Each child was tested alone in a small windowless room. All paper and pencil tests, which took about 25 minutes, were administered first, in a random order of presentation. The second part of the experimental session consisted of the reaction time test and also took about 25 minutes. The child was seated in an armchair equipped with a stabilimetric cushion. The reaction time apparatus was attached to the right arm of this chair. Each subject was told that the experimenter was interested in how fast he or she was, and how still he or she could sit. During the task the chair was facing a blank wall and the lights were dimmed in order to eliminate as many extraneous variables as possible.

RESULTS

An analysis of variance indicated that the four experimental groups did not differ significantly in age or I.Q. (Table 1). The teacher-rated Conners' scores for the asthmatic and NC groups were unavailable because of parental reticence concerning school involvement when their children were experiencing no educational

difficulties. Ethical considerations dictated that such requests be honoured. The analysis performed on the scores for the remaining two groups (the HA and the BP groups) were nonsignificant, indicating that there were no differences between the two groups on any of the five factors, as rated by the teachers.

Due to absenteeism, equipment failure and lack of cooperation, there was incomplete data on some subjects. For statistical examination, the dependent variables were broken down into two multivariate analyses of variance (MANOVA). The first MANOVA was performed on that subset of the original 50 subjects who were missing no data on the 10 main dependent variables. The second MANOVA was performed on all those subjects missing no data on the story completion test.

The MANOVA performed on the 10 main dependent variables resulted in a significant main effect, F (3,45) = 2.05, $p<.01$. Table 2 presents the means and standard deviations for these variables. Univariate tests indicated that there were significant differences between the groups on 7 of the 10 variables (see Table 3). Dunn's test (cit. Kirk, 1968), an a priori test for non-orthogonal comparisons, was used in a post hoc fashion to examine the relationship between the groups on those dependent variables for which there was a significant univariate effect, with a .05 level of significance being employed. The dependent variables can be discussed under the headings of; 1) psychometric tests of impulsivity (the MFF and

Maze Test), 2) attention as measured by the reaction time task, and 3) tests of motor inhibition (false starts, interstimulus and redundant responses, and the stabilimetric cushion measure).

Psychometric tests of impulsivity

On the MFF it was found that the hyperactives made significantly more errors than did the asthmatic and NC groups, but not more than the BP group. The latter three groups did not differ from each other.

The hyperactives made significantly more contacts (touches to the sides of the maze), and contacts of longer duration on the maze test than the NC group, but they did not differ from the asthmatic or BP groups on either measure. The NC, asthmatic and BP groups did not differ significantly.

Reaction time task

The asthmatic, BP and NC groups all evidenced significantly faster reaction times than did the hyperactive group, while not differing significantly from each other.

Tests of motor inhibition

Hyperactives made more gross body movements than the NC and BP groups, but not more than the asthmatic children. The three non-hyperactive groups did not differ from each other.

The hyperactive group made more interstimulus and redundant responses than did the NC group, but not more than the asthmatic and BP groups. The latter three groups did not differ from each other on either measure.

The MANOVA performed on the story completion test scores also resulted in a significant main effect, $F(3,38) = 2.20$, $p<.01$. Table 4 presents the means and standard deviations of the story completion scores. Univariate analyses indicated that significant differences existed between the four groups on compromise responses, $F(3,38) = 3.79$, $p<.05$ and denial responses, $F(3,38)=7.15$, $p<.01$ (see Table 4).

Dunn's tests indicated that the hyperactive group made significantly fewer compromise responses that did the NC group, but an equal number to the asthmatics and the BP group. The three non-hyperactive groups did not differ significantly from each other. The hyperactives made significantly more denial responses than all three other groups, which did not differ from each other.

DISCUSSION

Comparison of the Hyperactive and Normal Control Children

In general the results of the present study replicate previous findings suggesting that hyperactive children are more inattentive, more impulsive and more easily frustrated than normal control children. The hyperactives also appeared more active than the normal control children as measured by the stabilimetric cushion. This suggests that although their apparent activity level may be amplified by other deficiencies, it may not be appropriate to simply label it an illusion dependent upon their more basic attentional deficit (Cromwell, Baumeister & Hawkins, 1963).

A small number of other discrepancies arose between present findings and past reports. For example, previous research has isolated a pattern of responding in the hyperactive child delineated by quick responses and high error rate (Campbell, Douglas & Morgenstern, 1971). It was found in the present study that the hyperactive group was no more hasty in responding on the MFF than the NC group, although the higher error rate was evident. A similar pattern was found on the maze test. Hasty execution (measured by total time) was not found to be characteristic of the hyperactive children, although maze contacts and duration (which are somewhat equivalent to the MFF error rate) did significantly differentiate between the two groups. Although the hyperactive group took an equal length of time to that of the NC's in making their first response, the excessive number of

errors seems to indicate that they did not utilize their time as efficiently for problem solving as did the NC group.

The hyperactive children in the present study did, in general, show poorer inhibitory control than the other children as evidenced by the higher rate of interstimulus and redundant responses. However, it is not clear why a greater number of false starts was not found as in previous research (Firestone and Douglas, 1975).

The hyperactive subjects in the present study evidenced slower mean reaction times than did the NC groups. This supports previous suggestions that hyperactive children are deficient in attentional processes (Cohen and Douglas, 1972; Firestone and Douglas, 1975). Also supported was the suggestion by Parry and Douglas (1974) that hyperactive children, as compared to NC , are unable to cope realistically with frustrating events. Instead they tend to deny the existence of such events. The extreme pessimism found by Parry and Douglas with hyperactives was not found in the present study.

Comparison of the Hyperactive with the Behavior Problem and Asthmatic Children

Of central interest to the present investigation was the performance of hyperactive children when compared to other children with problems. The results are thus discussed with this view in mind. It is important to recall that the BP children were differentiated

from the hyperactive group on the basis of disagreement between four sources (physician, psychologist, mother and teacher) concerning their diagnosis. Because of this it must be kept in mind that any differences found between the two groups may be spurious rather than an indication of real differences. They may, however, reflect real differences and justify the inclusion of the BP group as separate from the hyperactive group.

The performance of the BP group was similar to the hyperactives on all but three psychological measures. These children performed faster than the hyperactives on the reaction time task, suggesting superior attentional processes, they moved less on the stabilimetric cushion indicating greater motor inhibition, and they made fewer denial responses on the story completion test. The BP children did not differ from the NC's on these measures. The fact that the BP children performed as poorly as the hyperactive group on the MFF and the maze tests and the remaining tests of motor inhibition suggests that here at least may be one other pathological group who share some deficits with hyperactive children. The story completion test results indicate that hyperactives are not alone in having difficulty accepting compromise solutions to frustrating events. In general it seems that the behavior problem children

share deficits in impulse control with hyperactive children, but do not share their attentional problems.

Results indicate that the asthmatic group performed as poorly as the hyperactive group on several measures. They made as many contacts of long duration on the maze test as did the hyperactives. They also made as many interstimulus and redundant responses and as many gross body movements as measured by the stabilimetric cushion. Story completion scores indicated that the hyperactive and asthmatic groups seemed to find it equally difficult to accept realistic compromise solutions to frustrating events. It appears that the asthmatic children share deficits in impulse control and motor inhibition with hyperactive children but do not share their problems with attentional processes.

It is interesting to note that the asthmatic children appear to share certain psychological deficits with the hyperactive children, but are not perceived as behavior problems as are the hyperactives. Gittelman-Klein (1976) has pointed out that psychological and behavioral measures do not always correspond. Rather than being used synonymously, these measures might be used as complementary diagnostic tools.

The results of the present study corroborate previous suggestions concerning the specific deficits apparent in hyperactive children when compared to a normal control group. They appear to be more inattentive, more impulsive and more active than normal

children. They also find it more difficult to handle frustration realistically than do normal controls. The present results demonstrate, however, that similar deficits can be found in other pathological groups. In fact, the only deficit that remains, when the other pathological groups are considered, is that of attention. This suggests that the definition of hyperactivity based on the most commonly used criteria, may not be satisfactory. Further investigations are required to delineate the necessary and sufficient characteristics for the label of "hyperactive" for a child. Also, at least one pathological reference group ought to be included in any research into psychological disorders in order to provide additional control. Whether the similarities between the three pathological groups presented here are reactive to being ill, or are inherent in each pathology would also be worthwhile pursuing.

BIBLIOGRAPHY

Barkley, R.A. and Ullman, D.G. A comparison of objective measures of activity and distractibility in hyperactive and nonhyperactive children. Journal of Abnormal Child Psychology, 1975, 3(3), 231-243.

Campbell, S., Douglas, V.I., and Morgenstern, G. Cognitive styles in hyperactive children and the effects of methylphenidate. Journal of Child Psychology and Psychiatry, 1971, 12, 55-67.

Campbell, S. and Douglas, V.I. Cognitive styles and response to the threat of frustration. Canadian Journal of Behavioural Science, 1972, 4, 30-42.

Cohen, N.J., Douglas, V.I., and Morgenstern, G. The effect of of methylphenidate on attentive behavior and autonomic activity in hyperactive children. Psychopharmacologia, 1971, 22, 282-294.

Cohen, N.J., and Douglas, V.I. Characteristics of the orienting response in hyperactive and normal children. Psycho physiology, 1972, 9, 238-245.

Conners, C.K. A teacher-rating scale for use in drug studies with children. American Journal of Psychiatry, 1969, 126, 152-156.

Cromwell, R., Baumeister, A., and Hawkins, W. Research on activity level. In N.R. Ellis (ed.) Handbook of Mental Deficiency, New York: McGraw-Hill, 1963.

Douglas, V.I. Children's responses to frustration; a developmental study. Canadian Journal of Psychology, 1965, 19, 161-171.

Douglas, V.I. Stop, look and listen: the problem of sustained attention and impulse control in hyperactive and normal children. Canadian Journal of Behavioural Science, 1972a, 4(4), 259-282.

Douglas, V.I. Differences between normal and hyperactive children. A paper presented at the Symposium on the Clinical Use of Stimulant Drugs in Children, Key Biscayne, Florida, 1972b.

Douglas, V.I. Sustained attention and impulse control: Implications for the handicapped child. In Swets and Elliot (eds.) Psychology and the Handicapped Child, U.S. Office of Education, Washington, D.C., 1974.

Douglas, V.I., Parry, P., Marton, P., and Garson, C. Assessment of a cognitive training program for hyperactive children. Journal of Abnormal Child Psychology, 1976, 4(4), 389-410.

Douglas, V.I., Werry, J., and Weiss, G. Hyperactive behaviour in children: some findings regarding etiology and treatment. Canadian Journal of Psychology, 1965, 6, 219-

Dubey, D. Organic factors in hyperkinesis: a critical evaluation. American Journal of Orthopsychiatry, 1976, 46(2), 353-366.

Erikson, R.V. and Roberts, A.H. A comparison of two groups of institutionalized delinquents on Porteus Maze test performance. Journal of Consulting Psychology, 1967, 29, 224-

Firestone, P., Davey, J., Goodman, J. T., and Peters, S. The Effects of Caffeine and Methylphenidate on hyperactive children. Journal of Child Psychiatry. (In Press, 1978).

Firestone, P., and Douglas, V.I. The effects of reward and punishment on reaction times and autonomic activity in hyperactive and normal children. Journal of Abnormal Child Psychology, 1975, 3(30, 201-216.

Firestone, P., Lewy, F., and Douglas, V.I. Hyperactivity and physical anomalies. Canadian Psychiatric Association Journal, 1976, 21, 23-26.

Firestone, P., Peters, S., Rivier, M., Knights, B. Physical anomalies in hyperactives, retardates and normals, their parents and siblings. Journal of Child Psychology and Psychiatry. (In Press, 1978).

Gittelman-Klein, R., Klein, D., Abikoff, H., Katz, S., Gloisten, A., and Kates, W. Relative efficacy of methylphenidate and behaviour modification in hyperactive children: an interim report. Journal of Abnormal Child Psychology, 1976, 4(4), 361-380.

Keogh, B.K. Hyperactivity and learning disorders. Exceptional Children, 1971, 37, 101-108.

Kirk, R.E. Experimental Design: Procedures for the Behavioural Sciences, Brooks/Cole Pub. Co., 1968.

Knights, R.M., and Moule, A.D. Normative data on the motor-steadiness battery for children. Perceptual and Motor Skills, 1968, 26, 643-650.

Marwit, S., and Stenner, A.J. Hyperkinesis: delineation of two patterns. Exceptional Children, 1971, 38, 401-406.

Meichenbaum, D.H., and Goodman, J. T. Reflection-impulsivity and verbal control of motor behavior. Child Development, 1969, 40, 785-797.

Palkes, H., Stewart, W., and Kahana, B. Porteus maze performance of hyperactive boys after training in self-directed verbal commands. Child Development, 1968, 39, 817-826.

Parry, P., and Douglas, V.I. The effect of reward on the performance of hyperactive children. Paper presented at the Canadian Psychological Association Conference, Vancouver, 1974.

Porteus, S.D. New applications of the Porteus Maze test. Perceptual and Motor Skills, 1968, 26, 787-

Quay, H.C., and Werry, J.S. Psychopathological Disorders of Childhood. John Wiley and Sons, Inc., Toronto, 1972.

Rapoport, J., and Quinn, P.O. Minor physical anomalies (stigmata) and early developmental deviations: a major biologic subgroup of "hyperactive children." International Journal of Mental Health, 1975, 4, 29-44.

Schrager, J., Lindy, J., Harrison, S., McDermott, J., and Wilson, P. The hyperkinetic syndrome: some consensually validated behavioural correlates. Exceptional Children, 1966, 32, 635-637.

Sprague, R.L., and Toppe, L.K. Relationship between activity level and delay of reinforcement in the retarded. Journal of Experimental Child Psychology, 1966, 3, 390-397.

Sroufe, L.A. Drug treatment of children with behavior problems. In F. Horowitz (Ed.), Child Development Research. Vol. 4. Chicago: Chicago University Press, 1975.

Steg, J.P., and Rapoport, J.L. Minor physical anomalies in normal, neurotic, learning disabled and severely disturbed children. Journal of Autism and Childhood Schizophrenia, 1975, 5(4), 299-307.

Stewart, M.A., Pitts, F.N., Craig, A., and Dieruf, W. The hyperactive child syndrome. American Journal of Orthopsychiatry, 1966, 36(5), 861-867.

Sykes, D.H., Douglas, V.I., and Morgenstern, G. The effect of methylphenidate (Ritalin) on sustained attention in hyperactive children. Psychopharmacologia, 1972, 25, 262-274.

Waldrop, M.F., and Halverson, C.F. Minor physical anomalies and hyperactive behaviour in young children. In J. Hellmuth (ed.) The Exceptional Infant, New York: Brunner/Mazel, 1971.

Werry, J.S., and Sprague, R.L. Hyperactivity. In C.G. Costello (ed.) Symptoms of Psycholpathology, New York: Wiley, 1970.

Table 1

Description of the Four Groups Studied

	Hyperactive	Behavior Problem	Asthmatic	Control
Age	8.10±1.50	8.14±1.94	8.32±1.87	9.63±1.45
IQ	116.27±14.30	110.42±20.67	110.46±15.50	108.13±13.15
Teachers Ratings				
Conduct-Problem	.97±.60		1.08±1.12	
Inattentive-Passive	1.33±.59		1.18±5.7	
Tension-Anxiety	.28±.19		.80±.67	
Hyperactivity	2.30±.51		1.43±.96	
Sociability	.15±.32		.00±.00	

Table 2

Means and Standard Deviations for the 10 Dependent Variables In the First MANOVA

		Variable						
Group		MFF Latency	MFF Errors	Maze Duration	Maze Contacts	Maze Total Time	REACTION TIME	FALSE STARTS	INTERSTIMULUS RESPONSES
Hyperactive	X	15.79	18.00	3.77	17.65	51.79	.93	4.18	5.09
	S.D.	26.24	11.38	3.18	11.89	16.76	.35	2.60	5.20
Asthmatic	X	20.90	7.86	1.91	9.89	65.13	.60	3.66	3.86
	S.D.	13.36	5.34	1.62	7.70	28.65	.16	3.63	5.13
Normal Control	X	20.33	5.86	1.29	7.76	71.93	.45	2.53	.66
	S.D.	10.38	5.37	1.76	8.90	16.78	.09	2.66	.81
Behavior Problem	X	8.82	14.00	1.72	12.68	66.92	.54	8.25	1.62
	S.D.	4.70	5.45	.68	5.19	20.41	.11	10.60	2.61

n's = 11, 15, 15, and 8, respectively

Table 2 (Cont'd)

Means and Standard Deviations for the 10 Dependent Variables in the First MANOVA

Group	Variable	
	REDUNDANT RESPONSES	STABILIMETRIC CUSHION
Hyperactive	X 8.90	47.81
	S.D.7.91	49.89
Asthmatic	X 4.60	25.13
	S.D.5.90	25.19
Normal Control	X 1.93	13.13
	S.D.2.91	15.85
Behavior Problem	X 4.25	6.87
	S.D.4.55	10.00

n's = 11, 15, 15, and 8, respectively

Table 3

Univariate F test Statistics for the 10 Dependent Variables Used in the First MANOVA

Variable	MS	F
MFF Latency	309.35	1.26
MFF Errors	380.91	7.42**
MAZE Duration	14.04	3.42*
MAZE Contacts	225.18	2.86*
MAZE Total Time	886.20	1.88
REACTION TIME	.51	12.47**
FALSE STARTS	59.04	2.33
INTERSTIMULUS RESPONSES	51.36	3.31*
REDUNDANT RESPONSES	103.82	3.38*
STABILIMETRIC CUSHION	3455.99	4.09*

df = (3,45)

** $p < .01$

* $p < .05$

Table 4

Means and Standard Deviations for the 3 Dependent Variables in the Story Completion Test

Group		Variable: Compromise Responses	Pessimistic Responses	Denial Responses
Hyperactive	X	2.90	1.18	4.90
	S.D.	2.84	1.77	2.25
Asthmatic	X	4.15	2.15	2.69
	S.D.	2.07	2.67	2.05
Normal Control	X	5.86	1.53	1.60
	S.D.	2.26	1.92	1.45
Behaviour Problem	X	5.66	1.66	1.66
	S.D.	.57	.57	.57

n's = 11,13, 15, and 3, respectively